WHAT IS CLAIMED IS:

1. A culture chamber comprising:

(a) a tubular housing;

(b) a growth compartment within the housing;

(c) a fluid inlet;

(c) a fluid outlet; and

(d) a membrane carrier assembly transversing the growth compartment comprising

a support cylinder having a first end in communication with the fluid inlet and a second end in communication with the fluid outlet,

a molecular weight cut-off membrane secured to an exterior surface of the support cylinder, and

a chamber between the exterior surface of the cylinder and an interior surface of the membrane, the chamber in fluid communication with the fluid inlet and the fluid outlet.

2. The culture chamber of claim 1, wherein the housing is generally cylindrical in shape.

3. The culture chamber of claim 1, wherein the housing comprises

a right circular cylindrical sleeve having a first and a second end; and

a first and a second end fitting including

an interior projection, the interior projection having an outer diameter that sealingly fits within a bore of the sleeve,

a nozzle on an exterior side of the end fitting,

a counterbore in the interior projection, and

a through bore passing through the end fitting, the through bore extending from the nozzle to the counterbore.

4. The culture chamber of claim 3, wherein the sleeve has at least one penetration port extending from the bore of the sleeve to an exterior surface of the sleeve.

5. The culture chamber of claim 4, wherein the penetration port includes a gas venting means for allowing gas to escape from the growth compartment as the compartment is filled with fluid.

6. The culture chamber of claim 4, wherein the penetration port includes a fill means for inserting fluids into or removing fluids out of the growth compartment.

7. The culture chamber of claim 1, wherein the fluid inlet is connected to the housing through an inlet fluid conducting swivel.

8. The culture chamber of claim 1, wherein the fluid outlet is connected to the housing through an outlet fluid conducting swivel.

9. The culture chamber of claim 1, wherein the molecular weight cut-off membrane is dialysis tubing.

10. The culture chamber of claim 1, wherein the molecular weight cut-off membrane is flexible.

11. The culture chamber of claim 1, wherein the molecular weight cut-off membrane has a molecular weight cut-off of about 100,000 daltons or less.

12. The culture chamber of claim 1, wherein the support cylinder is symmetrical about a transverse midplane.

13. The culture chamber of claim 3, wherein the support cylinder has an axial blind hole in the first and second end of the cylinder, the blind hole aligned with the through bore of the end fitting when the cylinder is positioned in the counterbore of the end fitting.

14. The culture chamber of claim 13, wherein an interior end of the blind hole intersects a plurality of equispaced coplanar radial cross holes extending to the exterior surface of the cylinder.

15. The culture chamber of claim 14, wherein each radial cross hole intersects a surface pocket on the exterior surface of the cylinder.

16. The culture chamber of claim 15, wherein the surface pocket has an arcuate cross-section.

17. The culture chamber of claim 15, wherein the surface pocket extends from a point of intersection with the radial cross hole to a termination point on the exterior surface of the cylinder, the termination point positioned between the point of intersection and a mid-point of a length of the cylinder.

18. A culture vessel comprising:

(a) a housing having

a right circular cylindrical sleeve having a first and a second end; and

a first and a second end fitting including an interior projection, the interior projection having an outer diameter that sealingly fits within a bore of the sleeve to seal the first and second ends of the sleeve,

a nozzle on an exterior side of the end fitting,

a counterbore in the interior projection, and

a through bore passing through the end fitting, the through bore extending from the nozzle to the counterbore;

(b) a growth compartment within the bore of the sleeve;

(c) a support cylinder transversing the growth compartment, the support cylinder having a first and second end, each end having a fluid channel extending from the end of the cylinder to an exterior surface of the cylinder in a mid-section of the cylinder, wherein the fluid channel is in communication with the through bore of the end fitting whenever the cylinder is positioned in the counterbore of the interior projection;

(d) a molecular weight cut-off membrane secured to an exterior surface of the support cylinder to provide a chamber between the exterior surface of the cylinder and an interior surface of the membrane, the chamber in fluid communication with the fluid channels of the support cylinder.

19. A culture chamber comprising:

(a) a housing having

a right circular cylindrical sleeve having a first and a second end; and

a first and a second end fitting including an interior projection, the interior projection having an outer diameter that sealingly fits within a bore of the sleeve to seal the first and second ends of the sleeve,

a nozzle on an exterior side of the end fitting,

a counterbore in the interior projection, and

a through bore passing through the end fitting, the through bore extending from the nozzle to the counterbore;

(b) a growth compartment within the bore of the sleeve;

(c) a fluid inlet in fluid communication with the through bore of the first end fitting;

(d) a fluid outlet in fluid communication with the through bore of the second end fitting; and

(e) a membrane carrier assembly connecting the through bore of the first and second end fittings and transversing the growth compartment, the membrane carrier assembly comprising

a first and second end plug, each end plug having a through hole extending through a length of the end plug, wherein whenever the first and second end plugs

are positioned within the counterbores of the end fittings the through bore of the end fittings are concentric with the through holes of the first and second end plugs such that the first end plug is in communication with the fluid inlet and the second end plug is in communication with the fluid outlet, and

a molecular weight cut-off membrane secured at a first end to the first end plug and at a second end to the second end plug.

20. A culture bag comprising:

(a) a flexible outer wall having a first end, a second end, an internal side, and an external side, wherein the internal side of the wall is positioned to face an interior of the culture bag;

(b) an inlet means fused to the first end of the wall, wherein the inlet means includes an inlet end piece having an inlet interior counterbore and an inlet through bore ;

(c) an outlet means fused to the second end of the wall, wherein the outlet means includes an outlet end piece having an outlet interior counterbore and an outlet through bore; and

(d) a membrane carrier assembly connecting the inlet through bore to the outlet through bore including

a support cylinder positioned at a first end in the inlet interior counterbore and at a second end in the outlet interior counterbore, the support cylinder having a fluid channel at the first end and second ends in communication with the inlet and outlet through bores,

a molecular weight cut-off membrane secured to an exterior surface of the support cylinder, and

a chamber between the exterior surface of the cylinder and an interior surface of the membrane, the chamber in fluid communication with the inlet and outlet through bores.

21. A method of culturing cells in a culture chamber having a growth compartment transversed by a support cylinder surrounded by a molecular weight cut-off membrane to form a fluid chamber between the support cylinder and the membrane, the fluid chamber in fluid communication with a fluid inlet and a fluid outlet, the method comprising the steps of:

(a) filling the growth compartment with a nutrient media;

(b) placing a cell culture mixture in the nutrient media in the growth compartment;

(c) rotating the culture chamber;

(d) pumping additional nutrient media into the fluid inlet, through the fluid chamber, and out the fluid outlet; and

(e) transporting a number of compounds having a molecular weight less than the molecular weight cut-off of the membrane across the membrane.

22. A method for producing a protein from a cell culture comprising the steps of:

(a) obtaining a culture chamber having a growth compartment transversed by a support cylinder surrounded by a molecular weight cut-off membrane with a molecular weight cut-off less than the protein to be produced, wherein a fluid chamber is formed between the support cylinder and the membrane, the fluid chamber in fluid communication with a fluid inlet and a fluid outlet;

(b) filling the growth compartment with a nutrient media;

(c) placing a cell culture mixture in the nutrient media in the growth compartment, the cell culture mixture known to synthesize and secrete the protein;

(d) rotating the culture chamber;

(e) pumping additional nutrient media into the fluid inlet, through the fluid chamber, and out the fluid outlet;

(f) transporting a number of compounds having a molecular weight less than the molecular weight cut-off of the membrane across the membrane;

(g) growing the cell culture mixture in the rotating culture chamber, wherein the cell culture mixture synthesizes and secretes the protein into the nutrient media in the growth compartment; and

(h) removing the protein-containing nutrient media from the culture chamber.